

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application.

1. (Currently Amended) A heat exchanger including plate fins and ~~tube~~ tubes comprising:

a plurality of fins stacked at respective intervals;₃ and

a plurality of heat exchanger tubes penetrating each of said fins in a fin-stacking direction, said heat exchanger exchanging heat between a first fluid flowing inside said heat exchanger tubes and a second fluid flowing outside said heat exchanger tubes, ~~through said heat exchanger tubes and said fins~~, wherein

~~each of said fins includes a plurality of cut-raised portions, at least one~~ located on both of upstream and downstream sides of said fins with respect to a direction of flow of the second fluid flowing outside said heat exchanger tubes,

the cut-raised portions on the upstream side and the cut-raised portions on the downstream side are symmetrically disposed with respect to a center line connecting respective centers of said heat exchanger tubes, the center line being aligned in a column direction that extends parallel to an edge of each of said fins,

~~each of said cut-raised portion corresponding portions corresponds to each of said a respective heat exchanger tubes and being tube,~~

said cut-raised portions are disposed substantially only within a region one of a plurality of regions of said fin, each of said regions being centered about a respective heat exchanger tube and satisfying

$$W_s = (1 - \phi) D_p + \phi D$$

$$1.0 \geq \phi > 0.5,$$

~~Ws is entire spread the width of each of said at least one cut-raised portion regions corresponding to each of said~~ respective heat exchanger tubes in a the

column direction ~~that extends along an end of said fin on an upstream side of the second fluid,~~

D is ~~an~~ the outer diameter of each of said heat exchanger tubes, ~~and~~

Dp is ~~alignment~~ the pitch of said heat exchanger tubes in the column direction,

no cut-raised portion is present in an area of said fin centered, in the column direction, between adjacent pairs of said heat exchanger tubes and having a width Wf, in the column direction, satisfying

$$Wf = \phi (Dp - D), \text{ and}$$

$$Wf + Ws = Dp.$$

2. (Currently Amended) The heat exchanger according to claim 1, wherein said ~~at least one cut-raised-portion~~ portions corresponding to each of said heat exchanger tubes ~~is are~~ are disposed only in a region of said ~~fin~~ fin which falls within 130 degrees ~~in~~ of a central angle of the corresponding heat exchanger tube, toward ~~an upstream or~~ and ~~downstream direction~~ directions of the second fluid.

3. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised-~~portion~~ portions has two opposite edges disconnected from a main body of said fin, at least one of ~~said~~ the corresponding edges extending obliquely relative to the column direction.

4. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised-~~portion~~ portions has two opposite edges disconnected from a main body of ~~said~~ the corresponding fin, at least one of said edges extending in a radial direction of the corresponding heat exchanger tube.

5. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised-~~portion~~ portions has two opposed side ends connected to a

main body of ~~said~~ the corresponding fin, at least one of said side ends extending in a direction perpendicular to the column direction.

6. (Currently Amended) The heat exchanger according to claim 1, including at least two cut-raised portions for each of said heat exchanger tubes, said cut-raised portions being disposed symmetrically with respect to an axis passing through the center of said corresponding heat exchanger tube and extending in a direction perpendicular ~~or parallel~~ to the column direction.

7. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised-portion portions has a shape raised alternately in a longitudinal direction of said heat exchanger tubes, ~~based on a main body of said fin~~.

8. (Currently Amended) The heat exchanger according to claim 1, wherein each of said fin fins includes a convex ~~shaped~~ protrusion continuously extending in the column direction.

9. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised-portion portions is cut and raised from a main body of said fin to form a bridge shape which has a leg segment connected to said main body, and a beam segment spaced apart from said main body.